AMENDMENTS TO THE CLAIMS

Kindly cancel claims **2-28** and **146**, amend claims **29** and **147** and add new claims **148-174** as shown in the listing of claims below. This listing of claims will replace all prior versions, and listings of claims in the application.

1-28 (cancel)

29. (currently amended) ~~The combinatorial optical processor of claim 28~~ A combinatorial optical processor, comprising one or more optical modules; wherein at least one of the one or more optical modules includes N addressable optical elements, where N is an integer greater than 1, wherein the N addressable optical elements are configured such that, depending on a state of each addressable optical element, the combinatorial optical processor may provide at least 2^N addressable filter functions, wherein the N addressable optical elements are stacked in series such that light forming an image sequentially passes through all N addressable optical elements for all 2^N addressable filter functions,
wherein each of the at least 2^N addressable filter functions produces a unique transform between an object and an image whereby there are at least 2^N unique transforms.

30. (original) The combinatorial optical processor of claim 29 wherein the at least 2^N transforms form a set of related transforms.

31. (original) The combinatorial optical processor of claim 30 wherein an n^{th} transform is related to an $(n+1)^{th}$ transform in the same way as an $(n-1)^{th}$ transform is related to the n^{th} transform, wherein n is an integer between 1 and N-1.

32. (original) The combinatorial optical processor of claim 31 wherein, for an object at a given object location, each of the at least 2^N transforms images the object at a different addressable output plane location, whereby there are at least 2^N addressable output plane locations.

33. (original) The combinatorial optical processor of claim 32 wherein each of the at least 2^N addressable output plane locations lies along the same optic axis as the input plane.

34. (original) The combinatorial optical processor of claim 32 wherein the at least 2^N addressable output plane locations are uniformly spaced apart.

35. (original) The combinatorial optical processor of claim 30 wherein each of the at least 2^N transforms images the object at a different addressable magnification, whereby there are at least 2^N addressable magnifications.

36. (original) The combinatorial optical processor of claim 30 wherein each of the at least 2^N transforms images the object at a different addressable beam deflection angle, whereby there are at least 2^N addressable beam deflection angles.

37. (original) The combinatorial optical processor of claim 29 wherein one or more of the addressable optical elements are selected from the group consisting of variable efficiency optics, holographic optical elements, and nonlinear optics, holographic optical elements imbedded in electrically-activated liquid crystals and electrooptic diffractive optical elements in domain patterned ferroelectric materials.

38. (original) The combinatorial optical processor of claim 29 wherein the N addressable optical elements are randomly addressable.

39. (previously presented) The combinatorial optical processor of claim 38 wherein each addressable optical element is characterized by at least two states.

40. (original) The combinatorial optical processor of claim 39 wherein each of the at least two states for a given addressable optical element is characterized by a different value for an optical property of the given addressable optical element.

41. (original) The combinatorial optical processor of claim 40 wherein each addressable optical element is a holographic optical element

42. (original) The combinatorial optical processor of claim 41 wherein the holographic optical element is a lens incorporated within a liquid crystal structure.

43. (original) The combinatorial optical processor of claim 40 wherein the optical property is a focal length.

44. (original) The combinatorial optical processor of claim 40 wherein between 2 and N randomly addressable optical elements are configured as a stack such that a total focal length of the stack f_{tot} may be approximated by:

$$f_{tot} = \left(\frac{1}{f_1} + \frac{1}{f_2} \cdots \frac{1}{f_n} \right)^{-1},$$

wherein $f_1, f_2 \ldots f_n$ are the focal lengths of the n addressable optical elements.

45. (original) The combinatorial optical processor of claim 44 wherein the stack is a stack of thin lenses.

46. (original) The combinatorial optical processor of claim 38 wherein the unique transform is selected from the group consisting of image distance transforms, object distance transforms, image magnification transforms, image plane curvature transforms, object plane curvature transforms, angular beam deflection transforms, spatial frequency transforms and beam spot size transforms.

47. (original) The combinatorial optical processor of claim 38 wherein a state of each of the N addressable optical elements may be determined by a control signal.

48. (original) The combinatorial optical processor of claim 47 wherein the control signal is chosen from the group consisting of electric, optical, thermal, mechanical, magnetic, acoustic and electromagnetic control signals.

49. (original) The combinatorial optical processor of claim 47 wherein the control signal is a digital control signal.

50. (original) The combinatorial optical processor of claim 49 wherein the digital control signal is an N-bit control signal.

51. (original) The combinatorial optical processor of claim 50 wherein each bit of the digital control signal corresponds to a unique one of the N addressable optical elements, whereby a value of a given bit determines a state of a corresponding one of the N addressable optical elements.

52. (original) The combinatorial optical processor of claim 49 wherein the combinatorial optical processor is configured to convert the digital control signal to one or more analog output optical signals.

53. (original) The combinatorial optical processor of claim 47, further comprising a control conduit coupled to one or more of the addressable optical elements.

54-145 (cancel)

146. (cancel)

147. (currently amended) A combinatorial optical processor, comprising one or more optical modules; wherein at least one of the one or more optical modules includes N randomly addressable optical elements, where N is an integer greater than 1,
wherein the N randomly addressable optical elements are stacked in series such that light forming an image sequentially passes through all N addressable optical elements, wherein the N randomly addressable optical elements are configured such that, depending on a state of each randomly addressable optical element, the combinatorial optical processor may provide at least 2^N randomly addressable filter functions, wherein the N randomly addressable optical elements are stacked in series such that light forming an image sequentially passes through all N addressable optical elements for all 2^N randomly addressable filter functions,
wherein each of the at least 2^N randomly addressable filter functions produces a unique transform between an object and an image whereby there are at least 2^N different transforms,
wherein the at least 2^N transforms form a set of related transforms,
wherein an n^{th} transform is related to an $(n+1)^{th}$ transform in the same way as an $(n-1)^{th}$ transform is related to the n^{th} transform, wherein n is an integer between 1 and N-1,
wherein one or more of the optical modules includes a nonlinear optical medium having one or more subsections that define one or more of the N addressable optical elements.

148. (new) The combinatorial optical processor of claim 147 wherein the optical processor having N randomly addressable optical elements includes an optical medium having one or more subsections that define one or more of the randomly addressable optical elements; and means for altering the optical properties of the subsections.

149. (new) The combinatorial optical processor of claim 29 wherein the one or more optical modules including N addressable optical elements includes an optical medium having one or more subsections that define one or more of the addressable optical elements; and means for altering the optical properties of the subsections.

150. (new) The combinatorial optical processor of claim 149 wherein the means for altering the optical properties provide one or more optical address beams.

151 (new) The combinatorial optical processor of claim 150 wherein optical medium is an electro-optic medium

152 (new) The combinatorial optical processor of claim 151 wherein the means for altering the optical properties include one or more contact pads disposed proximate the optical medium and a voltage source coupled to one or more of the contact pads.

153 (new) The combinatorial optical processor of claim 149 wherein the one or more optical modules including N addressable optical elements includes an optical medium having one or more subsections that define the one or more addressable optical elements.

154 (new) The combinatorial optical processor of claim 153 wherein two or more of the optical modules are linked and oriented relative to each other such that optical transforms may be performed along two or more axes relative to an axis of propagation.

155 (new) The combinatorial optical processor of claim 154 wherein the two or more modules comprise a first module and a second module wherein each of the first and second modules performs a one-dimensional lens optical transform, whereby the optical processor performs two one-dimensional lens optical transforms and wherein the first and second modules are relatively oriented such that the two one-dimensional lens optical transforms are substantially perpendicular to each other whereby optical transforms in two dimensions can be achieved.

156. (new) The combinatorial optical processor of claim 153 wherein the optical medium exhibits optical nonlinearities.

157. (new) The combinatorial optical processor of claim 156 wherein the optical nonlinearities include second order nonlinearities.

158. (new) The combinatorial optical processor of claim 156 wherein the optical nonlinearities include third order nonlinearities.

159. (new) The combinatorial optical processor of claim 153 wherein the optical medium includes a material selected from the group of KH_2PO_4, KDP, or $LiNbO_3$.

160. (new) The combinatorial optical processor of claim 153, further comprising one or more address beam sources, wherein each address beam source may produce an address beam that interacts with a corresponding subsection of the optical medium to alter one or more optical properties of the subsection.

161. (new) The combinatorial optical processor of claim 153 wherein optical medium includes an electro-optic medium.

162. (new) The combinatorial optical processor of claim 161 wherein the electro-optic medium includes a liquid crystal.

163. (new) The combinatorial optical processor of claim 162 wherein the liquid crystal may have two or more states of refractive index as determined by an electric field applied across at least a portion of the electro-optic medium.

164. (new) The combinatorial optical processor of claim 161, further comprising one or more contact pads disposed proximate the optical medium.

165. (new) The combinatorial optical processor of claim 164, further comprising a voltage source coupled to one or more of the contact pads.

166. (new) The combinatorial optical processor of claim 164, further comprising one or more dispersed optics disposed proximate one or more of the contact pads.

167. (new) The combinatorial optical processor of claim 166, wherein the dispersed optics include refractive, diffractive and binary optic lenses, micro-optic lenslets, bragg gratings, prisms, holographic optical elements, liquid crystals, ferroelectrics, semiconductors, electro-optics, polymers, thin films, glass or plastic.

168. (new) The combinatorial optical processor of claim 166, further comprising one or more dispersed optics disposed within the electro-optic medium.

169. (new) The combinatorial optical processor of claim 168, wherein the dispersed optics include refractive, diffractive and binary optic lenses, micro-optic lenslets, bragg gratings, prisms, holographic optical elements, liquid crystals, ferroelectrics, semiconductors, electro-optics, polymers, thin films, glass or plastic.

170. (new) The combinatorial optical processor of claim 168, wherein the dispersed optics include one or more birefringent materials one or more optically isotropic materials.

171. (new) The combinatorial optical processor of claim 170 wherein the dispersed optics are configured such that along a first polarization axis, the materials comprising the dispersed optics have a common refractive index and wherein along a second polarization axis, the materials comprising the dispersed optics have two or more refractive indices.

172. (new) The combinatorial optical processor of claim 170 wherein the contact pads include one or more polarization rotators.

173. (new) The combinatorial optical processor of claim 172 wherein the polarization rotators are selected from the group of dichroic films, liquid crystals, and electro-optic half-wave plates.

174. (new) The combinatorial optical processor of claim 170 wherein the contact pads include one or more polarizers.